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NON-PHARMACOLOGIC INTERVENTIONS FOR STRESS MANAGEMENT IN COLLEGE STUDENTS

Joanne K. Singleton [*], Lucille R. Ferrara

[1] College of Health Professions, Pace University, New York, USA

*Corresponding author: jsingleton@pace.edu

Abstract

Stress, both positive and negative, is an ever-present part of life for most individuals. College students are most vulnerable for various factors which may include change in living situations, increased degree of learning responsibilities, social factors, and fear of the unknown, to name a few. Providing strategies for the relief of stress that are accessible and practical and do not require pharmacologic intervention were explored. Diaphragmatic breathing and Animal Assisted Activity were two strategies that have been shown to aid in stress relief and were the focus of this study. This randomized controlled study employed three arms, an AAA group, a DB group, and a control group. College students 18 years and older were recruited for participation, which included veterans students. Of the 14 recruited, 10 completed the study. Biomarkers, AA, cortisol, HR, and BP were measured. Two psychometric tests, PSS and SVAS were also used to measure the stress response. Results showed an overall decrease of stress pre and post intervention as reflected in these biomarkers, specifically with AA and cortisol levels. A decrease in the PSS and SVAS was also seen.

Keywords: stress, college students, psychological stress, physiological stress, non-pharmacologic interventions

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Introduction

University students overall are reporting high levels of stress. Almost half of college students in a past survey, that pre-dates Covid reported experiencing more than average stress, 47% found academics to be traumatic or very difficult to handle, and 44% said they experienced more than average stress (American College Health Association, 2014). Stress presents a serious risk to well-being for all college students, and within college students there are some, such as veteran students, who may be more vulnerable to stress. Veteran college students do not have the same profile as traditional college students. They tend to be older than their college student contemporaries, may be juggling work, life, and school, may have physical or emotional limitations, including chronic pain, and many have serious financial concerns (Callahan & Jarrat, 2014; Campbell & Riggs, 2015; Norman, Rosen, Himmerich, Myers, Davis, Brown, & Piland, 2015; Cate & Davis, 2016). All of these characteristics of veteran students, aside from whatever stress they carry from their military service, increase their vulnerability to stress.

"Stress is essentially reflected by the rate of all the wear and tear caused by life," it is essential to learn "how to keep its damaging effect "distress" to a minimum" (Selye, p. xvi). Physiological and psychologic effects of stress can be immediate or delayed, acute or long term (Rabkin, Struening, 1976). The sympathetic nervous system is activated by stress which can lead to a pro-inflammatory response, which can lead to physiologic and/or psychological health conditions (Muscatell & Eisenberger, Cooper, Dewe & O'Driscoll, 2001). Stress can interfere with learning (Baram, Chen, Burgdorff & Dubé, 2008; Joëls & Baram 2009), which is the goal of college education, and this in turn can create a cascading cycle of stress. The stakes for success are high for all college students; given the characteristics of veteran college students, it may be on the higher end of the continuum for them and add to their stress

response. That said, it would be beneficial to provide strategies for all college students, including veteran students, geared toward the relief of stress without relying on pharmacologic interventions. Diaphragmatic breathing and Animal Assisted Activity are two great examples of these types of strategies and are the focus of this study.

Diaphragmatic Breathing

Diaphragmatic breathing is a well know intervention for stress reduction. When experiencing stress breathing becomes shallow and fast and comes from the chest region. Expanding the diaphragm deeply with each inhalation causing the abdomen to rise is an immediate response to mediate and reduce stress. Counting the breaths and developing a pattern of deep inhalation and slow exhalation can decrease the respiratory rate, and in turn, decrease heart rate, blood pressure, salivary cortisol, alpha amylase, and one's psychological perception of stress (Benson, 1993; Busch, 2012; Sundram, 2014; Ma, 2017). Diaphragmatic breathing can be easily learned and self-directed once a stress trigger has been identified or a stressful situation is occurring. Diaphragmatic breathing has been shown to be effective in college students (Perciavalle, 2017) for the relief of stress.

Animal Assisted Activity

Animal Assisted Activity which is defined as a "planned and goal-oriented informal interaction and visitation conducted by the human-animal team for motivational, educational, and recreational purposes" (AHAIO, 2014) is also used as a means of stress reduction. According to Friedmann, Son & Saleem (2015) evidence that the study of animal assisted activities (AAA) reduce stress has accumulated over the past twenty years. Individual AAA is found to be more effective than group AAA, with dogs being the selected animal. Further, Friedmann, Son & Saleem postulate that AAA stress reduction effectiveness is related to a person's level of stress, as well as a person's attitude toward the AAA animal. Freund, McCune, Esposito, Gee & McCardle (2016) state, "There are indications that just having an animal in the room reduces anxiety, allowing energy to be used more constructively for the task at hand" (p. 60.) Animal assisted interventions have been shown to have positive effects on stress behaviorally and physiologically (Cole et al, 2007; Hansen, Messinger, Baun & Megel, 1999 Beetz, et at., 2011; Handlin et al., 2011; Bojorek, 2014; Barker, Barker, McCain & Schubert, 2015). In the general veteran population, Krause-Parello, Sarni & Padden identified, in a narrative review of the literature, various forms of canine assistance, including AAA, as beneficial for veterans with post-traumatic stress disorder (2016).

The Chemistry of the Stress Response

In addition to heart rate (HR), blood pressure (BP), and respiratory rate (RR), other biochemical responses occur during stress. The release of α-amylase a naturally occurring protein enzyme, and a steroid hormone, cortisol are two main components that are secreted during stress and were measured. Both α-amylase and cortisol levels are significantly affected by psychological and physiological stress and are used in this study as biomarkers to detect variations in their levels before and after a stress reduction session incorporating diaphragmatic breathing and animal assisted activities. The significance of measuring of both α-amylase and cortisol with regard to effects on psychologic and physiologic response are well documented in the literature (Ibraham, et al, 2017; Ying, et al, 2015; Wahbeh, et al, 2016; Fournier, et al; 2017; Marcheselli & Cortellini, 2016; Foody, James and Leader, 2015; Inagaki and Eisenberger, 2016).

In their study, Inagaki and Eisenberger (2016) found positive correlations between stress reduction and the sympathetic nervous system response, specifically α-amylase and cortisol levels, when providing emotional support. Wahbeh, et al (2016) studied the effects of mindfulness on α-amylase and cortisol levels in combat veterans with posttraumatic stress disorder. In both studies, α-amylase and cortisol levels were used as reliable biomarkers in understanding the human response to stress.

Methods

This study explored the effect of stress reduction techniques on stress in the college population. Participants for this study were recruited among all students with a special emphasis to include veteran college students. Thirteen participants were recruited and were randomized to one of three arms: an animal assisted activity intervention (Group A), a diaphragmatic breathing intervention (Group B), and a control group who read stress reduction materials and handouts (Group C). Ten of the thirteen participants completed the study, and three dropped out of the study.

The goal of this research was to provide information and add knowledge with regard to alleviating stress with interventions that are non-pharmacologic. In an effort to establish measurable and reliable data, salivary alpha amylase and cortisol samples were taken pre and post intervention as well as soft biomarkers which included heart rate, respiratory rate, and

blood pressure. Psychometric data was collected using two well established measures, the Perceived Stress Scale, and the Stress Visual Analog Scale.

Psychological Stress Factor Measures

The Perceived Stress Scale (PSS-10) is a 10 item self-report scale that assesses perceptions of burdens, and unpredictable and uncontrollable aspects of life over the past month. A five-point Likert scale is scored from never (0) to very often (4). Reliability and validity of the PSS-10 has been established with college students for assessing perceived stress. College student samples have reported coefficient alphas of 0.84 and 0.85 (Cohen, Kamarch and Mermelstein, 1983; Roberti, Harrington and Storch, 2006; Cohen and Janicki-Devert, 2012). Visual analog scales are widely used for self-report severity ratings with good reliability and validity across a variety of health conditions. Barker, Barker, McCain, and Schubert (2015), and Barker, Barker and Schubert (2014), validated the Stress Visual Analog Scale (SVAS), in studies of college students. The SVAS assess immediate perceived stress. It is a 15 cm line that measures a single item, stress. One end of the scale states "none" the opposite end states, "most severe imaginable." Participants mark on the scale where they assess their feeling of stress to be in the present moment.

In combining both physiologic and psychologic measures, it was the intent of the researchers to increase the integrity of the data. Once randomized to a group, participants were schedule for one session per week for four weeks for a total of four session. Data were collected as follows:

- Pre and post intervention data collected on the following biomarkers: blood pressure, pulse, and respiratory rate were measured, and the self-report Stress Visual Analog Scale
- Pre and post intervention sessions one and four the following biomarkers: salivary alpha amylase and salivary cortisol
- Pre intervention at all sessions participants completed the Perceived Stress Scale

Results

The results of this study are reported from a case series perspective for the psychological self report stress measures and the biological measures. Due to the small sample size, multiple data points over time, are presented descriptively as averages of all study participants on their

pre and post intervention readings, across all four waves of intervention and data collection. Out of the ten study participants, 2 received the animal-assisted therapy intervention, 5 received instructions on how to complete breathing exercises, and 3 were in a control group. The population was evenly split by gender identification, with 50% of the population reporting that they were female and 50% reporting that they were male. The largest race/ethnicity of the sample was Hispanic/Latino (40%, N=4). The majority of the population (80%, N=8) were undergraduate students. Almost three-fourths of the sample had some military experience (70%, N=7), and almost one-third reported being active military (30%, N=3). Half of the population had reported being involved in combat in the military (50%, N=5).

Psychological Stress Measures: Study Outcomes

Throughout all 4 sessions, many participants experienced a decrease in their SVAS reading after their intervention. For the first interaction, the difference between the pre- and post-measures ranged from -0.1 to -5.1 points. For the second, the observed decrease in study participants ranged from -0.1 to -4.7 points. For the third interaction, the decrease in individual participants was less, and ranged from -0.1 to -5.1 points. Lastly, for the fourth interaction, the decrease in pre- and post-measures ranged from -0.4 to -2.8 points. It is interesting to note that participants in the animal-assisted activity group experienced a multi-point reduction in their SVAS reading after each intervention.

On the Perceived Stress Scale during the first wave, two participants had scores within the low stress range (0-13), five participants had scores within the moderate stress range (14-26), and three had scores within the high perceived stress range (27-40). Overall, ratings stayed relatively consistent across waves for this scale.

Biological Measures: Study Outcomes

Improvement from pre-session to post-session is seen across all groups, sessions, and respondents. The average value in stress reduction from pre-session to post-session for each of the stress factors assessed is as follows. There was an average reduction of 4.17% in Salivary Cortisol, and 3.53% in Salivary Amylase from pre to post session across the study. The across study average pre vs post session reduction in blood pressure was 5.32% for systolic BP, and 2.99% for diastolic BP. Average pre vs post session reduction in heart rate was 4.84%, and the greatest pre-post reduction that was seen was respiratory rate with an average reduction of 15.99%. Figure 1 represents the trend line of change in stress factor by

session. The trendline for stress factors pre vs post session was either flat or positive. Stress reduction is this size sample is not tied to session number, however, with a larger sample noted improvement in stress reduction, based on what is gleaned from this analysis, would be expected.

Discussion

Overall, this study shows post-session stress reduction in college students across interventions and control for one of more of the stress factors assessed. Each of the tools used in the study assessed stress The PSS and SVAS provided self-report on psychological stress over the past 30 days (PSS), and in the present moment (SVAS). Biomarkers, HR, RR, BP, and salivary alpha amylase and cortisol provided objective measures of physiological stress. Respiratory rate was the stress factor that showed the greatest reduction from pre-post condition over the study. The challenges to study recruitment and retention resulted in a small sample size in the pilot study, however the pilot study will help to illuminate study revisions to recruit and retain a larger sample for a future study. It is expected that with a larger sample greater specificity of the effects of the interventions individually, and compared to each other, and the control will be revealed, as well as the potential of sustainability of stress reduction over time.

It is interesting to note that there was stress reduction across all study participants, including those in the control group. Those in the control group were provided with information on stress to read after their pre-session assessment measures. What was common to each of the interventions as well as the control group was that the participant was required to focus their attention. To be aware of stress one has to notice. Awareness, noticing stress, is the first step to managing stress. It will be important for future studies to consider providing reading material unrelated to stress for the control group to assess if the nature of reading may have had a stress reduction effect in this pilot study or if simply requiring attentional focus on an unrelated topic can result in stress reduction as measured by the assessment of stress factors. Sustainability of stress reduction is critical to psychological and physiological health outcomes. In this pilot study respiratory rate was the most sensitive stress factor in demonstrating stress reduction. At study completion and outcomes assessment when a stress reduction intervention is seen to be effective it will be ethical to provide participants with resources to continue on their own if feasible to engage in or practice the effective stress reduction intervention. This must also include providing them with reliable and simple ways

to assess their stress reduction using the intervention. Respiratory rate, if it continues to be a highly sensitive biological indicator for stress reduction can easily be self assessed, and this is also true of heart rate and blood pressure. The PSS and SVAS can also be easily shared for self-administration for stress reduction outcomes of intervention.

Conclusion

Non-pharmacologic stress reduction interventions can be beneficial for all humans, and because they may have no to low costs, may be particularly attractive to college students. Prior to the Covid 19 pandemic college students were reporting high levels of stress. The American College Health Association reported pre-pandemic health information on undergraduate college students and identified 38% of those survey experienced more than average stress, and another 9% who experienced tremendous stress over the past 12 months (2019). College students are living and learning though the unprecedented challenges of Covid 19. Since the beginning of the Covid 19 pandemic an increase in stress, anxiety, and mental health conditions in college students related to Covid 19 have been reported (Revert-Villarroya, et al.; Albert, 2021). In a nationwide survey of college students reporting on their mental health in May and June of 2020 it was found that 85% of those survey (N = 504) experienced increased stress during Covid 19 (Albert, 2021). Stress remains a critical area for concern and intervention to support the psychological and physical health of college students.

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